IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:
Verhaverbeke

Serial No.: 10/676,182

Confirmation No.: 6792

Filed: September 30, 2003

For: Process for Forming a Dilute Sulfuric Peroxide Solution at the Point-of-Use

§ Group Art Unit: 1746

§ Examiner: Saeed T. Chaudhry

MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence and the documents referred to as attached therein are being facsimile transmitted to the U.S. Patent and Trademark Office to fax number 571-273-8300, or electronically transmitted to the U.S. Patent and Trademark Office via EFS-Web to the attention of Examiner Saeed T. Chaudhry, on the date shown below.

9/10/07
Date

Signature

Dear Sir:

SUBSTITUTE APPEAL BRIEF

Applicant submits this Substitute Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1746 dated July 11, 2007, finally rejecting claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45, and in response to an Examiner's Answer dated July 11, 2007, which included new grounds of rejection. The final rejection of claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 is appealed.

TABLE OF CONTENTS

Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

Related Appeals and Interferences

Applicant asserts that no other appeals or interferences are known to the Applicant, the Applicant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 are pending in the application. Claims 1-37 were originally presented in the application. Claims 1, 3, 9, 14, 17, 24, 29, and 34 were amended, and claims 6-8, 21-23, and 31-33 were canceled in the preliminary amendment filed on September 28, 2004. Claims 1, 3, 4, 5, 9, 10, 14, 16-20, 24, 25, 29, 30, 34, and 37 were amended, claim 15 was canceled, and claims 38-45 were added in the Response to Office Action dated July 28, 2005, that was filed on October 27, 2005. Claims 1, 5, 14, 20, 29, and 30 were amended, and claims 16, 39, 41, and 44 were canceled in the preliminary amendment filed with a Request for Continued Examination (RCE) on April 10, 2006. Claims 1, 14, 25, 29, and 37 were amended in the Response to Office Action dated June 13, 2006, that was filed on August 30, 2006. Claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 stand finally rejected as discussed below. The final rejection of claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 is appealed. The pending claims are shown in the attached Claims Appendix.

Status of Amendments

All claim amendments have been entered by the Examiner. No amendments to the claims were proposed after the final rejection.

Summary of Claimed Subject Matter

Claimed embodiments of the invention provide methods of forming cleaning solutions and removing residues from substrates with the cleaning solutions (abstract).

In the embodiment of independent claim 1, a method for removing a residue from a substrate surface is provided. The method comprises mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution (paragraph [0015] on p. 5, paragraph [0018] on p.6-7). The concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight (paragraph [0018] on p. 7). The intermediate solution is diluted with water to form a cleaning solution (paragraph [0013] on p. 5, paragraph [0017] on p. 6), wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm (paragraph [0016] on p. 6). An aliquot of the cleaning solution is applied to a substrate surface for a time period, and the aliquot is rinsed from the substrate surface with water to form a wash solution (paragraph [0013] on p. 5, abstract).

In the embodiment of independent claim 14, a method for cleaning a residue from a substrate surface is provided. The method comprises combining an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution (paragraph [0015] on p. 5-6, paragraph [0018] on p. 6-7). The concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight (paragraph [0018] on p. 7). The intermediate solution is diluted with water to form a cleaning solution, and the substrate surface is exposed to an aliquot of the cleaning solution (paragraph [0013] on p. 5, paragraph [0017] on p. 6, abstract). The cleaning solution comprises hydrogen peroxide at a

concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm (paragraph [0016] on p. 6). The substrate surface is then rinsed with water to remove a residue and the aliquot of cleaning solution (paragraph [0010] on p. 4, paragraph [0013] on p. 5, abstract).

In the embodiment of independent claim 29, a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface is provided. The method comprises providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight (paragraph [0015] on p. 5, paragraph [0018] on p. 6-7). The aqueous solution and a hydrogen peroxide solution are combined to form an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution (paragraph [0018] on p. 6-7). The intermediate solution is diluted with water to form a cleaning solution (paragraph [0013] on p. 5, paragraph [0017] on p. 6), wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a concentration of about 1,000 ppm or less (paragraph [0016] on p. 6). The cleaning solution is delivered to a substrate surface, and at least a portion of a residue is removed from the substrate surface. The substrate surface is rinsed to remove the cleaning solution (paragraph [0010] on p. 4, paragraph [0013] on p. 5, abstract).

Grounds of Rejection to be Reviewed on Appeal

1. (Original) Claims 1-2, 5, 9-12, 14, 20, and 24-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Ramachandran, et al.* (WO-02/10480).

2. (Original) Claims 1-2, 5, 9-12, 14, 20, and 24-27 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* (U.S. Patent No. 6,630,074).

3. (New) Claims 1-2, 5, 9-12, 14, 20, 24-27, and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* (EP-0918081).

4. (Original) Claims 1, 2, 5, 9-10, 14, 20, 24-25, and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kuhn-Kuhnenfeld, et al.* (U.S. Patent No. 4,100,014).

5. (New) Claims 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* (U.S. Patent No. 6,630,074 or EP-0918081) or *Ramachandran, et al.* or *Kuhn-Kuhnenfeld, et al.* in view of *Gotoh, et al.* (U.S. Patent No. 5,650,041).

6. (New) Claims 36-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* (U.S. Patent No. 6,630,074 and EP-0918081) or *Ramachandran, et al.* in view of *Gotoh, et al.* (U.S. Patent No. 5,650,041) as applied to claim 34 above, and further in view of *Oonishi, et al.* (U.S. Patent No. 6,273,959).

ARGUMENTS

1. Reply with respect to the rejection of claims 1-2, 5, 9-12, 14, 20, and 24-27 under 35 U.S.C. § 103(a) over *Ramachandran, et al.* (WO-02/10480).

THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 5, 9-12, 14, 20, AND 24-27 UNDER 35 U.S.C. § 103(A) BECAUSE *RAMACHANDRAN, ET AL.* DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 1-2, 5, 9-12, 14, 20, and 24-27 stand rejected under 35 U.S.C. § 103(a) over *Ramachandran, et al.* on grounds that *Ramachandran, et al.* describes using the cleaning solution as claimed and that it would have been obvious to mix hydrofluoric acid and sulfuric acid with hydrogen peroxide at different concentrations before further diluting with water to obtain the cleaning solution since it is known in the art to dilute cleaning compositions with water before cleaning a surface. Applicant respectfully traverses the rejection on grounds that the reference *Ramachandran, et al.* does not teach, suggest, provide motivation for, or otherwise render obvious the subject matter of the pending claims.

Ramachandran, et al. describes a method of forming a cleaning solution that includes mixing 98% by weight of sulfuric acid solution with 30% by weight of hydrogen peroxide solution and 49% by weight of hydrofluoric acid solution and adding these solutions to water to provide the desired percentages of the solution components (*Ramachandran, et al.*: page 6, lines 5-9). Applicant submits the concentrations as taught by *Ramachandran, et al.* are stock concentrations commonly available from chemical vendors, and Applicant respectfully submits that *Ramachandran, et al.* does

not teach or suggest using a concentration of sulfuric acid other than 98% to form the solution described therein (*Ramachandran, et al.*, page 6, lines 5-9).

Ramachandran, et al. discloses an intermediate mixture of water, 98% sulfuric acid, and 30% hydrogen peroxide formed directly in a tank, and either a) 49% hydrofluoric acid is added to the mixture within the tank, or b) the mixture is added into another tank containing the 49% hydrofluoric acid. Applicant submits the reference *Ramachandran, et al.* mixing scheme is directed to adjusting the concentration of hydrofluoric acid.

Conversely, the present application claims a process for cleaning a substrate with a cleaning solution that is formed through multiple intermediate solutions, each of which distinguishes *Ramachandran, et al.* Independent claims 1, 14, and 26 recite an "aqueous solution" which contains water, about 70% or less of sulfuric acid, and hydrofluoric acid. These acids have already been diluted and disassociated relative to their concentrated counter parts. The aqueous solution is combined with a hydrogen peroxide solution to form an "intermediate solution". The use of a dilute sulfuric acid concentration (about 70% or less of sulfuric acid) is used to effect the claimed temperature difference as recited in claims 1, 14, and 26. Subsequently, the intermediate solution is further diluted with water. Again, the order of addition, as well as, the concentration of each component is relevant features that are claimed in the present application and are novel and non-obvious in the disclosure of *Ramachandran, et al.*

Therefore, *Ramachandran, et al.* discloses an intermediate mixture of water, 98% sulfuric acid, and 30% hydrogen peroxide, while the present claims provide an intermediate solution of water, about 70% or less of sulfuric acid, and hydrofluoric acid.

In the current application, a 67% concentration of sulfuric acid is combined with a hydrogen peroxide solution ***to cause a small and manageable increase in temperature*** (***<3°C***) (Paragraph [0018]).

Applicant notes that the Examiner asserts that as claims 1, 14, and 26 include the phrase "3° C or less" with respect to the claimed temperature difference, claims 1, 14, and 26 read on a 0°C temperature difference. Applicant submits the Examiner has erred as the claimed 3°C or less temperature difference is dependent upon the

temperatures of the aqueous solution and hydrogen peroxide solution. Applicant also submits that mixing of the 98% sulfuric acid with the 30% hydrogen peroxide as taught by *Ramachandran, et al.* is an exothermic disassociation that results in a temperature **of more than 3°C** greater than temperatures of the initial components. Thus, Applicant submits that the temperature limitations present in claims 1, 14, and 26 do not read on a 0° C difference as asserted by the Examiner. Applicant also submits that the claimed temperature difference is not taught or suggested by the reference *Ramachandran, et al.* regardless of whatever 0°C is included.

Applicant also notes that the Examiner asserts that as claims 1, 14, and 26 include the phrase "about 70% or less by weight" with respect to a concentration of sulfuric acid, claims 1 and 14 read on 0% sulfuric acid. Applicant respectfully submits that the Examiner errs in asserting that the aqueous solution in the claims does not require sulfuric acid, as the claim language "an aqueous solution comprising sulfuric acid and hydrofluoric acid" illustrates that the aqueous solution comprises sulfuric acid, *i.e.*, more than 0%, and the claim language "wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight" further specifies that the amount of sulfuric acid in the solution is about 70% or less, *i.e.*, not more than about 70%. Applicant further submits that claims 1 and 14 require at least about a 1% concentration of sulfuric acid after dilution with water, and this about 1% concentration is derived from a sulfuric acid having a concentration greater than 1%. Applicant submits that the claimed sulfuric acid content cannot be "0%" as asserted by the Examiner. Applicant also submits that the claimed lower sulfuric acid concentration is not taught or suggested by the reference *Ramachandran, et al.*

Therefore, *Ramachandran, et al.* does not teach, show, or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, with a hydrogen peroxide solution to produce an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution, diluting the intermediate solution with water to form a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration

within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time period, and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1. Applicant respectfully requests withdrawal of the rejection of claim 1 and of claims 2, 5, and 9-12, which depend thereon.

Similarly, *Ramachandran, et al.* does not teach or suggest a hydrogen peroxide solution at a concentration of less than 30%. Applicant submits the claimed hydrogen peroxide at a predetermined weight ratio of about 1 to about 20 is not taught or suggested by the reference *Ramachandran, et al.* and further effects the claimed temperature difference of 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution. Therefore, Applicant submits that the reference *Ramachandran, et al.* does not teach, show, or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, with a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution, diluting the intermediate solution with water to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight,_sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14. Applicant respectfully requests withdrawal of the rejection of claim 14 and of claims 20 and 24-27, which depend thereon.

2. Reply with respect to the rejection of claims 1-2, 5, 9-12, 14, 20, and 24-27 under 35 U.S.C. § 103(a) over *Rath, et al.* (U.S. Patent No. 6,630,074).

THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 5, 9-12, 14, 20, AND 24-27 UNDER 35 U.S.C. § 103(A) BECAUSE *RATH, ET AL.* DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 1-2, 5, 9-12, 14, 20, and 24-27 stand rejected under 35 U.S.C. § 103(a) over *Rath, et al.* on grounds that *Rath, et al.* describes using the cleaning solution as claimed and that it would have been obvious to mix hydrofluoric acid and sulfuric acid with hydrogen peroxide at different concentrations before further diluting with water to obtain the cleaning solution since it is known in the art to dilute cleaning compositions with water before cleaning a surface. Applicant respectfully traverses the rejection on grounds that the reference *Rath, et al.* does not teach, suggest, provide motivation for, or otherwise render obvious the subject matter of the pending claims.

As discussed above in the first argument, Applicant respectfully submits that claims 1 and 14 require a concentration of sulfuric acid at about 70% or less by weight. Similar to the reference *Ramachandran, et al.*, the reference *Rath, et al.* describes a method of forming a cleaning solution that includes mixing 98% by weight of sulfuric acid with other components (*Rath, et al.*: column 4, lines 8-15). Applicant submits that no other concentrations are taught or suggested by the reference *Rath, et al.* Further, the reference *Rath, et al.* does not teach or suggest mixing the sulfuric acid and other components to produce an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution. Applicant submits the concentration of sulfuric acid as taught by *Rath, et al.* would produce an exothermic disassociation having a temperature

gradient between the temperatures of the aqueous solution and the hydrogen peroxide solution that is much greater than 3° C that would require additional time and/or significant amounts of water being added to the intermediate solution to cool the solution. Therefore, Applicant respectfully submits that *Rath, et al.* does not teach, suggest, or provide a motivation for using sulfuric acid at the claimed concentration of 70% by weight or less to form an intermediate solution at a predetermined temperature before further diluting the intermediate solution with water. As *Rath, et al.* does not teach or suggest mixing or combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution, *Rath, et al.* does not teach or suggest all of the elements of claims 1-2, 5, 9-12, 14, 20, and 24-27. Applicant respectfully requests withdrawal of the rejection of claims 1-2, 5, 9-12, 14, 20, and 24-27.

3. Argument with respect to the new rejection of claims 1-2, 5, 9-12, 14, 20, 24-27, and 38 under 35 U.S.C. § 103(a) over *Rath, et al.* (EP-0918081).

THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 5, 9-12, 14, 20, 24-27, and 38 UNDER 35 U.S.C. § 103(A) BECAUSE *RATH, ET AL.* DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 1-2, 5, 9-12, 14, 20, 24-27, and 38 stand rejected under 35 U.S.C. § 103(a) over *Rath, et al.* on grounds that *Rath, et al.* describes using the cleaning solution as claimed and that it would have been obvious to mix hydrofluoric acid and sulfuric acid with hydrogen peroxide at different concentrations before further diluting with water to obtain the cleaning solution since it is known in the art to dilute cleaning compositions with water before cleaning a surface. Applicant respectfully traverses the rejection on grounds that the reference *Rath, et al.* does not teach, suggest, provide motivation for, or otherwise render obvious the subject matter of the pending claims.

Applicant respectfully submits that independent claims 1, 14, and 29 require a concentration of sulfuric acid at about 70% or less by weight. As discussed above, the reference *Rath, et al.* describes a method of forming a cleaning solution that includes mixing 98% by weight of sulfuric acid with other components (*Rath, et al.*: column 4, lines 8-15). Applicant submits that no other concentrations are taught or suggested by the reference *Rath, et al.* Further, the reference *Rath, et al.* does not teach or suggest mixing the sulfuric acid and other components to produce an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution. Applicant submits the concentration of sulfuric acid as taught by *Rath, et al.* would produce an exothermic disassociation having a temperature gradient between the temperatures of the aqueous

solution and the hydrogen peroxide solution that is much greater than 3° C that would require additional time and/or significant amounts of water being added to the intermediate solution to cool the solution. Therefore, Applicant respectfully submits that *Rath, et al.* does not teach, suggest, or provide a motivation for using sulfuric acid at the claimed concentration of 70% by weight or less to form an intermediate solution at a predetermined temperature before further diluting the intermediate solution with water. As *Rath, et al.* does not teach or suggest mixing or combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution, *Rath, et al.* does not teach or suggest all of the elements of claims 1-2, 5, 9-12, 14, 20, 24-27, and 38. Applicant respectfully requests withdrawal of the rejection of claims 1-2, 5, 9-12, 14, 20, 24-27, and 38.

4. Reply with respect to the rejection of claims 1, 2, 5, 9-10, 14, 20, 24-25, and 38 under 35 U.S.C. § 103(a) over *Kuhn-Kuhnenfeld, et al.* (U.S. Patent No. 4,100,014).

THE EXAMINER ERRED IN REJECTING CLAIMS 1-2, 5, 9-12, 14, 20, 24-25, AND 38 UNDER 35 U.S.C. § 103(A) BECAUSE *KUHN-KUHNENFELD, ET AL.* DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 1, 2, 5, 9-10, 14, 20, 24-25, and 38 stand rejected under 35 U.S.C. § 103(a) over *Kuhn-Kuhnenfeld, et al.* on grounds that *Kuhn-Kuhnenfeld, et al.* describes a cleaning solution comprising 1 to 30% by weight of hydrofluoric acid, 2 to 30% by weight of hydrogen peroxide, 1 to 75% by weight of sulfuric acid, and 15 to 95% by weight of water and that it would have been obvious to manipulate the percentage of the hydrogen fluoride concentration and to mix hydrofluoric acid and sulfuric acid with hydrogen peroxide at different concentrations before further diluting with water to obtain the cleaning solution. Applicant respectfully traverses the rejection.

Kuhn-Kuhnenfeld, et al. describes forming a cleaning solution by mixing 40% weight aqueous hydrofluoric acid, 30% weight aqueous hydrogen peroxide, and concentrated aqueous sulfuric acid of about 98% by weight (*Kuhn-Kuhnenfeld, et al.*: column 1, lines 51-52, column 1, line 67-column 2, line 5). Applicant respectfully submits that *Kuhn-Kuhnenfeld, et al.* does not teach or suggest using a concentration of sulfuric acid of about 70% or less by weight to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution that is then diluted to form the cleaning solution. Applicant submits the concentration of sulfuric acid as taught by *Kuhnenfeld, et al.* would produce an exothermic disassociation having a temperature

gradient between the temperatures of the aqueous solution and the hydrogen peroxide solution that is much greater than 3° C that would require additional time and/or significant amounts of water being added to the intermediate solution to cool the solution. As *Kuhn-Kuhnenfeld, et al.* does not teach or suggest mixing or combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution, *Kuhn-Kuhnenfeld, et al.* does not teach or suggest all of the elements of claims 1, 2, 5, 9-10, 14, 20, 24-25, and 38. Applicant respectfully requests withdrawal of the rejection of claims 1, 2, 5, 9-10, 14, 20, 24-25, and 38.

5. Argument with respect to the new rejection of claims 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45 under 35 U.S.C. § 103(a) over *Rath, et al.* (U.S. Patent No. 6,630,074 or EP-0918081) or *Ramachandran, et al.* (WO-02/10480) or *Kuhn-Kuhnenfeld, et al.* (U.S. Patent No. 4,100,014) in view of *Gotoh, et al.* (U.S. Patent No. 5,650,041).

THE EXAMINER ERRED IN REJECTING CLAIMS 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45 UNDER 35 U.S.C. § 103(A) BECAUSE *RATH, ET AL.* OR *RAMACHANDRAN, ET AL.* OR *KUHN-KUHNENFELD, ET AL.* IN VIEW OF *GOTOH, ET AL.* DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* or *Ramachandran, et al.* or *Kuhn-Kuhnenfeld, et al.* in view of *Gotoh, et al.* on grounds that it would have been obvious to use a cleaning solution surfactant as described by *Gotoh, et al.* in the cleaning solution of *Rath, et al.* or *Ramachandran, et al.* or *Kuhn-Kuhnenfeld, et al.* since surfactants are known to reduce surface tension and increase wettability of the substrate. Applicant respectfully traverses the rejection.

As discussed above in the previous arguments, *Rath, et al.*, *Ramachandran, et al.*, and *Kuhn-Kuhnenfeld, et al.* do not teach or suggest all of the elements of independent claims 1, 14, and 29 as *Rath, et al.*, *Ramachandran, et al.*, and *Kuhn-Kuhnenfeld, et al.* do not teach or suggest mixing or combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution that is then

diluted to form the cleaning solution. Applicant submits the concentration of sulfuric acid as taught by *Rath, et al.*, *Ramachandran, et al.*, and *Kuhn-Kuhnenfeld, et al.* would produce an exothermic disassociation having a temperature gradient between the temperatures of the aqueous solution and the hydrogen peroxide solution that is much greater than 3° C that would require additional time and/or significant amounts of water being added to the intermediate solution to cool the solution. Applicant further submits that *Gotoh, et al.*, individually or in combination with *Rath, et al.*, *Ramachandran, et al.*, and *Kuhn-Kuhnenfeld, et al.* does not teach or suggest mixing or combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, to form an intermediate solution at a predetermined temperature of about 3° C or less higher than the temperatures of the aqueous solution and the hydrogen peroxide solution. Thus, *Rath, et al.* or *Ramachandran, et al.* or *Kuhn-Kuhnenfeld, et al.* in view of *Gotoh, et al.* does not teach or suggest all of the elements of claims 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45. Applicant respectfully requests withdrawal of the rejection of claims 3-4, 17-19, 29-30, 34-35, 40, 42-43, and 45.

6. Argument with respect to the new rejection of claims 36-37 under 35 U.S.C. § 103(a) over *Rath, et al.* (U.S. Patent No. 6,630,074 and EP-0918081) or *Ramachandran, et al.* (WO-02/10480) in view of *Gotoh, et al.* (U.S. Patent No. 5,650,041) as applied to claim 34 above, and further in view of *Oonishi, et al.* (U.S. Patent No. 6,273,959).

THE EXAMINER ERRED IN REJECTING CLAIMS 36-37 UNDER 35 U.S.C. § 103(A) BECAUSE *RATH, ET AL.* OR *RAMACHANDRAN, ET AL.* IN VIEW OF *GOTO, ET AL.* AS APPLIED TO CLAIM 34, AND FURTHER IN VIEW OF *OONISHI, ET AL.*, DOES NOT TEACH, SUGGEST, OR RENDER OBVIOUS USING AN AQUEOUS SOLUTION COMPRISING SULFURIC ACID, WITH A HYDROGEN PEROXIDE SOLUTION, WHEREIN THE CONCENTRATION OF THE SULFURIC ACID IS ABOUT 70% OR LESS BY WEIGHT, TO FORM AN INTERMEDIATE SOLUTION AT A PREDETERMINED TEMPERATURE THAT IS DILUTED TO FORM A CLEANING SOLUTION.

Claims 36-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Rath, et al.* or *Ramachandran, et al.* in view of *Gotoh, et al.* (U.S. Patent No. 5,650,041) as applied to claim 34 above, and further in view of *Oonishi, et al.* (U.S. Patent No. 6,273,959) on grounds that it would have been obvious to incorporate the steps of sonication disclosed by *Oonishi, et al.* into the processes of *Rath, et al.*, *Kuhn-Kuhnenfeld, et al.*, or *Ramachandran, et al.* to enhance the removal effect with the sonication. Applicant respectfully traverses the rejection.

As discussed in the arguments above, *Rath, et al.*, *Ramachandran, et al.*, and *Gotoh, et al.* do not teach or suggest all of the elements of independent claim 29. Applicant submits that *Oonishi, et al.*, individually or in combination with *Rath, et al.*, *Ramachandran, et al.*, or *Gotoh, et al.* also does not teach or suggest all of the elements of independent claim 29. Thus, *Rath, et al.*, *Ramachandran, et al.*, and *Gotoh, et al.* in view of *Oonishi, et al.* does not teach or suggest all of the elements of dependent claims 36 and 37, which include the elements of independent claim 29. Applicant respectfully requests withdrawal of the rejection of claims 36 and 37.

CONCLUSION

For the reasons presented above, Applicant respectfully submits that the rejection of claims 1-5, 9-14, 17-20, 24-30, 34-38, 40, 42, 43, and 45 under 35 U.S.C. § 103(a) is improper. Reversal of the rejection of the claims is respectfully requested.

Respectfully submitted,

Keith M. Tackett
Registration No. 32,008
Patterson & Sheridan, L.L.P.
3040 Post Oak Blvd. Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Attorney for Appellant(s)

545570_1

CLAIMS APPENDIX

1. (Previously Presented) A method for removing a residue from a substrate surface, comprising:

mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, with a hydrogen peroxide solution to produce an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution,

diluting the intermediate solution with water to form a cleaning solution, wherein the cleaning solution comprises:

hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight;

sulfuric acid at a concentration within a range from about 1% to about 10% by weight; and

hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm;

applying an aliquot of the cleaning solution to a substrate surface for a time period; and

rinsing the aliquot from the substrate surface with water to form a wash solution.

2. (Original) The method of claim 1, wherein the wash solution remains isolated from the cleaning solution.

3. (Previously Presented) The method of claim 1, wherein the cleaning solution further comprises a surfactant selected from the group consisting of glycol ethers, carboxylic acids, amines, sulfonamides, fluoroalkylsulfonamides and derivatives thereof.

4. (Previously Presented) The method of claim 3, wherein the cleaning solution has a surfactant concentration within a range from about 1 ppm to about 100 ppm.

5. (Previously Presented) The method of claim 1, wherein the residue is selected from the group consisting of resist, polymeric, silicon, silicon oxide, aluminum, aluminum oxide, particulates of surface matter, and particulates of substrate matter.

6-8. (Canceled)

9. (Previously Presented) The method of claim 1, wherein the cleaning solution is heated to a temperature within a range from about 15°C to about 80°C.

10. (Previously Presented) The method of claim 9, wherein the time period is less than about 2 minutes.

11. (Original) The method of claim 1, wherein the substrate surface comprises a material selected from the group consisting of aluminum, copper, tungsten, titanium, tantalum, titanium nitride, tantalum nitride, tungsten nitride and combinations thereof.

12. (Original) The method of claim 11, wherein the residue comprises a resist and the substrate surface comprises aluminum.

13. (Original) The method of claim 1, wherein the cleaning process includes sonication.

14. (Previously Presented) A method for cleaning a residue from a substrate surface, comprising:

combining an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight, with a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution,

diluting the intermediate solution with water to form a cleaning solution;

exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises:

hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight;

sulfuric acid at a concentration within a range from about 1% to about 10% by weight; and

hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm; and

rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution.

15. (Canceled)

16. (Canceled)

17. (Previously Presented) The method of claim 16, wherein the aqueous solution further comprises a surfactant.

18. (Previously Presented) The method of claim 17, wherein the surfactant is selected from the group consisting of glycol ethers, carboxylic acids, amines, sulfonamides, fluoroalkylsulfonamides and derivatives thereof.

19. (Previously Presented) The method of claim 18, wherein the cleaning solution has a surfactant concentration within a range from about 1 ppm to about 100 ppm.

20. (Previously Presented) The method of claim 14, wherein the residue is selected from the group consisting of resist, polymeric, silicon, silicon oxide, aluminum, aluminum oxide, particulates of surface matter, and particulates of substrate matter.

21-23. (Canceled)

24. (Previously Presented) The method of claim 14, wherein the cleaning solution is heated to a temperature within a range from about 15°C to about 80°C.

25. (Previously Presented) The method of claim 24, wherein the substrate surface is exposed to the aliquot of cleaning solution in a single pass that lasts less than about 2 minutes.

26. (Original) The method of claim 14, wherein the substrate surface comprises a material selected from the group consisting of aluminum, copper, tungsten, titanium, tantalum, titanium nitride, tantalum nitride, tungsten nitride and combinations thereof.

27. (Original) The method of claim 26, wherein the residue comprises a resist and the substrate surface comprises aluminum.

28. (Original) The method of claim 14, wherein the cleaning process includes sonication.

29. (Previously Presented) A method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising:

providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, wherein a concentration of the sulfuric acid in the aqueous solution is about 70% or less by weight;

combining the aqueous solution and a hydrogen peroxide solution to form an intermediate solution at a predetermined temperature of about 3°C or less higher than temperatures of the aqueous solution and the hydrogen peroxide solution;

diluting the intermediate solution with water to form a cleaning solution, wherein the cleaning solution comprises:

hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight;

sulfuric acid at a concentration within a range from about 1% to about 10% by weight;

hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm; and

a surfactant at a concentration of about 1,000 ppm or less;

delivering the cleaning solution to a substrate surface;

removing at least a portion of a residue from the substrate surface; and

rinsing the substrate surface to remove the cleaning solution.

30. (Previously Presented) The method of claim 29, wherein the residue is selected from the group consisting of resist, polymeric, silicon, silicon oxide, aluminum, aluminum oxide, particulates of surface matter, and particulates of substrate matter.

31-33. (Canceled)

34. (Previously Presented) The method of claim 30, wherein the cleaning solution is heated to a temperature within a range from about 15°C to about 80°C.

35. (Original) The method of claim 34, wherein the substrate surface comprises a material selected from the group consisting of aluminum, copper, tungsten, titanium, tantalum, titanium nitride, tantalum nitride, tungsten nitride and combinations thereof.

36. (Original) The method of claim 35, wherein a sonication process is used in the cleaning solution.

37. (Previously Presented) The method of claim 36, wherein the cleaning solution is delivered to the substrate surface in a single pass that lasts less than about 2 minutes.

38. (Previously Presented) The method of claim 1, wherein the aqueous solution and the hydrogen peroxide solution are combined at a predetermined weight ratio of about 1 to about 20.

39. (Canceled)

40. (Previously Presented) The method of claim 1, wherein the aqueous solution contains by weight about 67% of sulfuric acid, about 0.4% of hydrogen fluoride and about 0.1% of a surfactant and the hydrogen peroxide solution contains by weight about 8% of hydrogen peroxide.

41. (Canceled)

42. (Previously Presented) The method of claim 14, wherein the aqueous solution contains by weight about 67% of sulfuric acid, about 0.4% of hydrogen fluoride and about 0.1% of a surfactant and the hydrogen peroxide solution contains by weight about 8% of hydrogen peroxide.

43. (Previously Presented) The method of claim 29, wherein the aqueous solution and the hydrogen peroxide solution are combined at a predetermined weight ratio of about 1 to about 20.

44. (Canceled)

45. (Previously Presented) The method of claim 29, wherein the aqueous solution contains by weight about 67% of sulfuric acid, about 0.4% of hydrogen fluoride and about 0.1% of a surfactant and the hydrogen peroxide solution contains by weight about 8% of hydrogen peroxide.

EVIDENCE APPENDIX

No evidence is attached.

RELATED PROCEEDINGS APPENDIX

No copies of decisions rendered by a court or the Board in a related appeal or interference are included as no related appeals or interferences have been identified.